

## **Chapter V**

### **Water Monitoring and Pollution Control Programs**

#### **Introduction**

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Chapter V presents new water quality management strategies implemented since the release of the 1996 Water Quality Inventory Report. For a detailed overview of Water Monitoring and Pollution Control Programs in general, refer to the 1996 edition of the State Water Quality Inventory Report available from the Department (see Title Page). This 1998 Report highlights changes and improvements to Water Monitoring and Pollution Control Programs as follows:

- Development and Implementation of Results-based Management System
- Improvements to Surface Water Quality Standards
- Implementation of Watershed Management Program
- TMDL Planning, Schedule and Development
- Implementation of Water Quality Monitoring Programs
- Implementation of Redesigned Ambient Stream Monitoring Network
- Comprehensive Assessment of New Jersey's Waters

#### **Development and Implementation of Results-based Management System**

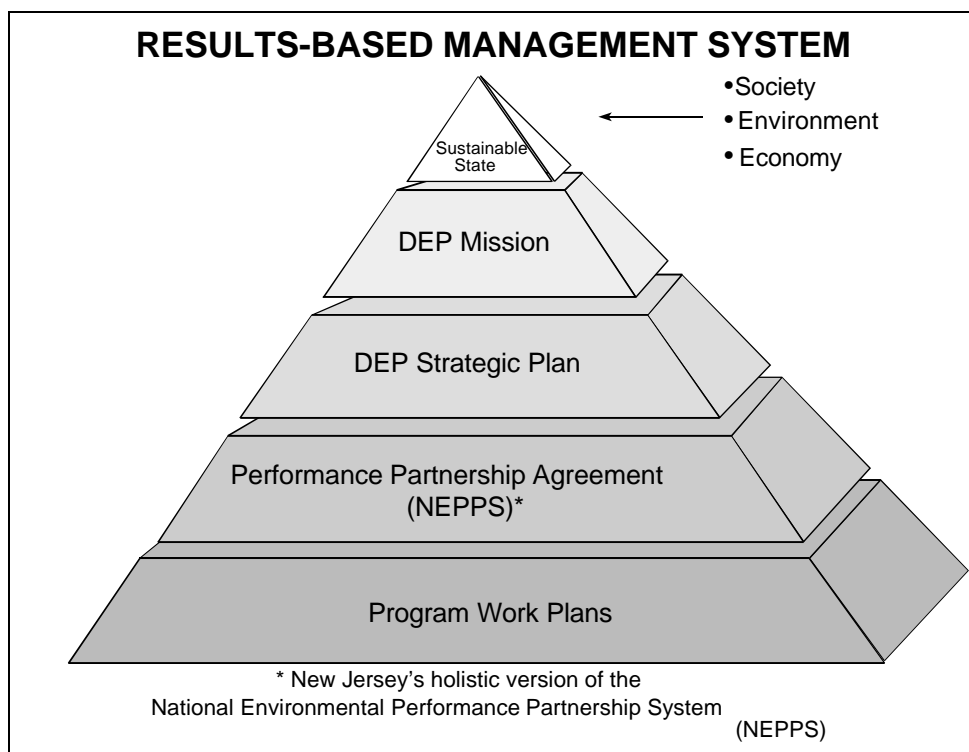
New Jersey has adopted a tiered planning approach in its environmental management efforts so as to ensure that all aspects are fully integrated. The figure below represents the framework of New Jersey's overall environmental management efforts. At the top of the pyramid is New Jersey's sustainable state efforts, followed by NJDEP's mission and Strategic Plan. The Strategic Plan is implemented through New Jersey's participation in NEPPS and, specifically, through the PPA, which is supported by program workplans. At each decreasing level of the pyramid, the amount of detail contained within the approach also increases. Additionally, the time horizon for the strategies changes from the Strategic Plan (4 year document) to the PPA (multi-year document) to the program workplans (annual).

The State of New Jersey is enhancing its implementation of results-based environmental management through its continued participation in the National Environmental Performance Partnership System (NEPPS). NEPPS emphasizes management for environmental results through its use of long-term goals and indicators as measures of environmental progress. The NEPPS process also places greater emphasis on scientific assessments of trends in environmental quality, and through its identification of key issues, provides many elements for use in long-term environmental strategic planning.

Through the Strategic Plan and NEPPS, environmental goals, milestones and indicators for thirteen goals areas, including water, land and natural resources have been selected. Environmental indicators for freshwater and drinking water quality have been developed and

reported in the Environmental Indicators Technical Report (NJDEP, 1998). Indicators for ground water, coastal waters, water supply, land and natural resources will be developed and reported over the next several years. These goals, milestones and indicators have undergone significant discussion with NJDEP managers and staff, as well as a wide variety stakeholders, including the regulated community, environmental groups, academics and citizens. It is expected that these statewide goals, milestones and indicators will be evaluated and tailored for watersheds through the watershed management program and will inform the statewide effort.

**Figure V-1: New Jersey's Results-Based Management System**



### **Improvements to Surface Water Quality Standards**

In April 1998, the Department adopted amendments to the Surface Water Quality Standards upgrading the water quality classification of 17 segments from non-trout to trout maintenance or trout maintenance to trout production. These changes in classifications were based on actual field data. Additional segments are being proposed for reclassification to trout maintenance or trout production in the Fall of 1999.

### **Implementation of the Watershed Management Program**

The Watershed Management Program is currently active in 6 WMAs (6,8,9,10,13 and 19), active at the watershed scale in 7 other WMAs (parts of 1,4,5,7,12,17 and 20), and is negotiating scopes of work in 3 WMAs (2,14,18). Currently NJDEP is not active in 4 WMAs (3,11,15 and 16). To the extent possible, watershed management activities are being integrated with ongoing Estuary Program activities in the New York/ New Jersey Harbor, Delaware River Estuary and most

recently, Barnegat Bay Estuary. Activities have focused on establishing Public and Technical Advisory Committees with watershed partners, developing Watershed Characterization and Assessments, planning and beginning to implement nonpoint source management implementation projects on a watershed basis. Contracts have been issued for watershed management planning and characterization activities in several WMAs. Efforts are also ongoing to plan, develop and implement TMDLs, as discussed below.

NJDEP has also emphasized public education and outreach targeted at adults and children as a key tool to successful watershed management. In addition, watershed management is being integrated into water rules, including NJPDES regulations, Surface Water Quality Standards, Watershed Management Planning Rules and Stormwater Management Rules. Notably, Watershed Management Planning Rules, which are being drafted, use watershed management planning to integrate wastewater management and water supply planning for the first time.

Through a constitutional amendment and the state Watershed Protection Act, funding has become available to NJDEP for watershed management activities, including contracts. Subsequent to adoption of the Watershed Management Planning Rules, some of this funding will also be made available as grants to watershed management groups. In addition, the federal Clean Water Action Plan has also brought additional nonpoint source management funds to New Jersey. These funds are being used for watershed-based nonpoint source management projects.

In New Jersey's coastal zone, integration of watershed management planning with coastal zone management is ongoing. NJDEP is drafting rules intended to facilitate implementation of the State Development and Redevelopment Plan through Coastal Area Facilities Review Act. The State Development and Redevelopment Plan seeks to focus development in designated centers and enhance protection of open space and environmentally sensitive areas.

### **TMDL Planning, Schedule and Development**

Through the Federal Clean Water Act, and State Water Pollution Control Act, water quality must be improved in waterbodies that do not meet Surface Water Quality Standards. Development of Total Maximum Daily Loads provides a tool to define acceptable loads of pollutants, usually in pounds per day, a waterway can receive and still meet water quality standards.

Point and nonpoint source loads, margin of safety and reserve capacity are considered in developing the TMDLs. TMDLs will be developed using the simplest approach that adequately addresses the problem. In some situations, new stream and effluent data may be used to run water quality models to simulate dry weather and storm conditions. Point and nonpoint discharges to the waterway must reduce their pollutant loadings to within acceptable levels based on the TMDL analysis. Implementation of TMDLs is expected to rely upon both regulatory means and voluntary actions including cooperative efforts by federal, state and local agencies and stakeholders that are adopted in Watershed Management Plans. Thus, the TMDL process provides a holistic framework for water quality management.

*Impaired Waterbodies List:* Waterbodies that do not meet Surface Water Quality Standards despite implementation of point and nonpoint source controls are identified on the Impaired

Waterbodies List. Impaired waterbodies are ranked based on the spatial extent, severity of the water quality issues. Ranked waterbodies were then prioritized for TMDL development based on actual or potential toxics issues, use as a drinking water supply, number of point sources, spatial distribution of TMDL projects and other factors. This Impaired Waterbodies List (303d List) is published every two years, pursuant to Section 303d of the Federal Clean Water Act.

Waterbodies may only be removed from the list if Surface Water Quality Standards are now being met, or if the original basis for the listing was flawed. The state and federal regulations for the Impaired Waterbodies List are being revised, and NJDEP is drafting a Technical Support Document to clarify 303d policies and procedures. State and federal regulations for the Impaired Waterbodies List require extensive public participation in the listing and delisting process. In addition, the Technical Support Document will be released for Interested Party Review later in 1999.

*303d Evaluation Monitoring:* In order to focus TMDL development on waterbodies with current impairments, 303d Evaluation Monitoring is being conducted by NJDEP. This monitoring effort is focused on metals and conventional constituents in freshwater streams. In New Jersey and nationally, concerns regarding the quality of historical metals data have been raised. In addition, total recoverable metals data were compared to dissolved criteria for protection of aquatic life, potentially overestimating of exceedences of metals criteria. Therefore, clean sampling and analysis techniques are being implemented and total recoverable and dissolved metals data are being collected from waterbodies on the 1998 303d List. Results will be used to propose delisting, additional monitoring or TMDL development as appropriate. 303d Evaluation Monitoring for conventional constituents (nutrients, dissolved oxygen) is being used to thoroughly define the spatial extent and severity of the problem to plan TMDL development. To date, 303d Evaluation Monitoring has been conducted in the Passaic Basin (WMAs 3,4,6), Monmouth Watersheds (WMA 12), Cooper/Rancocas/Pennsauken Watersheds (WMA 19), Saddle/ Hackensack Watershed (WMA 5). Monitoring will be conducted in the remaining WMAs over the next year.

#### *TMDL Schedule:*

EPA and NJDEP recently signed a Memorandum of Agreement that includes a schedule for TMDL development. The schedule is shown in Table V-1, and is based on Watershed Management Areas (See Figure II-2).

**Table V-1: TMDL Adoption Schedule**

| <b>Adoption</b> | <b>Location</b>              | <b>Notes</b>                        |
|-----------------|------------------------------|-------------------------------------|
| 1999            | NY/NJ Harbor                 | Nickel                              |
|                 | Delaware Estuary             | Volatile organics, chronic toxicity |
|                 | Whippany River Watershed     | Fecal coliform, Total phosphorus    |
| 2000            | Strawbridge Lake             | Burlington County                   |
|                 | Sylvan Lake                  | Burlington County                   |
| 2002            | Rancocas, Cooper, Pennsauken |                                     |
|                 | Manasquan River              |                                     |

| <b>Adoption</b> | <b>Location</b>                             | <b>Notes</b>  |
|-----------------|---|---|
|                 | Upper Passaic, Rockaway                     |   |
|                 | Pompton, Ramapo, Pequannock, Wanaque        |   |
|                 | Lower Passaic River                         | Non-tidal portion   |
|                 | Delaware Estuary                            | Dissolved oxygen  |
| 2003            | Millstone River                             |   |
|                 | North and South Branch of the Raritan River |   |
|                 | Saddle River                                |   |
|                 | Hackensack River and Pascack Creek          |   |
|                 | Raritan and South Rivers, Lawrence Brook    |   |
|                 | Wallkill, Pochuck, Papakating Creeks        |   |
|                 | Lower Delaware Tributaries                  |   |
|                 | Delaware River/Estuary                      | Metals, PCBs, DDT and Derivatives   |
| 2004            | Upper Delaware River Tributaries            |   |
|                 | Cohansey River                              |   |
|                 | Monmouth Watersheds                         |   |
|                 | Maurice River Watershed                     |   |
| 2005            | Elizabeth, Rahway, Woodbridge Rivers        |   |
|                 | Crosswicks Creek                            |   |
|                 | Delaware River/Estuary                      | Fecal coliform  |
| 2006            | Mullica, Wading River Watersheds            |   |
|                 | Great Egg Harbor, Tuckahoe                  |   |
|                 | Barnegat Bay Watershed                      |   |
| 2007            | Central Delaware Tributaries                |   |
|                 | Cape May                                    |   |
|                 | NY/NJ Harbor                                | PCBs, Dioxin, PAHs, Pesticides, Mercury, Dissolved oxygen, Fecal coliform |

*TMDL Development:* Development of TMDLs in the Whippany River and Delaware River Estuary are nearing completion. The Whippany River TMDL is being developed for fecal coliform and total phosphorus. The Delaware River Estuary TMDL is being developed for volatile organics, specifically 1,2 dichloroethane, tetrachloroethene, trichloroethene, and chronic toxicity. TMDLs will be developed in the future for polychlorinated biphenyls (PCBs), chlorinated pesticides including DDT and its derivatives and metals. In the New York/ New Jersey Harbor toxics of concern have been identified including nickel in the Hackensack, cadmium, mercury, total PCBs, dioxin, DDT and metabolites, dieldrin, PAHs and tetrachloroethylene, nitrogen and pathogens. Models to support TMDL development will be developed under contract in the near future.

### **Implementation of Surface Water Monitoring Programs**

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This section describes changes and improvements to NJDEP's surface water monitoring programs, and provides the reader with an overview of programs that were used to develop water quality assessments provided in Chapter III, even though some of these programs have not changed significantly since the 1996 Report.

### **Ambient Biological Network**

This program has not changed significantly since the 1996 Water Quality Inventory Report. It has been improved by the addition of a standardized habitat assessment component.

Freshwaters: The Ambient Biological Network (AMNET) utilizes benthic macroinvertebrate populations to screen waters for aquatic life designated use impairments in freshwater nontidal streams. These data were used to develop the aquatic life designated use assessment provided in Chapter 3 of this report and have been reported as an environmental indicator through NEPPS (NJDEP, 1998).

The occurrence of bottom dwelling organisms, such as insects, crustacea, snails and worms, known collectively as “benthic macroinvertebrates” is monitored in free-flowing streams. Benthic macroinvertebrates are common throughout New Jersey’s streams, fulfilling an important role in the aquatic food web. Species comprising the benthic macroinvertebrate community occupy distinct niches governed by environmental conditions and tier tolerance to pollution and habitat degradation. The occurrence of organisms that are tolerant and intolerant of pollution and habitat degradation is used to screen streams for potential impairments to aquatic life designated uses.

In 1992, the Department reactivated its Ambient Biomonitoring Network (AMNET) which, at the time of its last sampling in 1988, consisted of only 18 sampling sites, statewide. The new program consists of 763 stations and established sampling stations in most sub-watersheds. Under the this program, each of the five (5) major drainage basins are sampled for benthic macroinvertebrates on a rotating schedule of once every five years. The health of instream benthic macroinvertebrate communities is evaluated using statistical methodology developed by USEPA called the “Rapid Bioassessment Protocol, or RBP. To date, all stations have been monitored once, the Upper Delaware Water Region has been sampled twice and sampling in the Lower Delaware Water Region is ongoing.

Currently, data from this network are stored in-house, but will be uploaded to EPA’s STORET system in the near future. The Department publishes AMNET reports of results annually, with copies available either by contacting the Chief, Bureau of Freshwater & Biological Monitoring, or by downloading the reports from the Bureau’s WebPage.

Tidal Waters: NJDEP began implementation of a pilot benthic macroinvertebrate monitoring network in tidal areas, called BAYNET. Fifteen stations in tidal streams in the Atlantic Coastal Water Region were sampled once. As the Department collects additional data and gains experience with sampling and assessing these data, the results will be incorporated into appropriate water assessments. Copies of the network report of results are available from the Chief, Bureau of Freshwater & Biological Monitoring.

### **Ambient Stream Monitoring Network (ASMN)**

As described below, this program has changed significantly since the 1996 Water Quality Inventory Report. Data collected prior to the redesign were used for the swimmable designated

use assessments and water quality status and trends. Data collected after the redesign will be reported in the 2000 Water Quality Inventory Report.

In the Ambient Stream Monitoring Network (ASMN), physical, chemical and sanitary water quality data are collected in freshwater, nontidal streams. Sediment quality data are also collected. Data from this network (prior to the redesign described below) are used to develop the "swimmable designated use attainment" assessments for streams; to evaluate physical and chemical water quality status with respect to Surface Water Quality Standards and to evaluate water quality trends. These data were used extensively to develop water quality indicators (NJDEP, 1998) and the water quality section of NJDEP's State of the Environment Report (NJDEP, 1998a).

The NJDEP and the United States Geological Survey (USGS) have cooperatively operated the Ambient Stream Monitoring Network since the 1970s. The purpose of the network was to evaluate water quality in freshwater nontidal streams near reservoirs and lakes, point sources, and various land uses. The network began with over 200 stations and was reduced to as few as 78 stations in the mid-1990's. Through these gradual reductions, the network became biased toward the downstream, and often more polluted, portions of New Jersey's watersheds. Station locations did not facilitate water quality assessments conducted at the Watershed Management Area level and were not well coordinated with the Ambient Biological Network (AMNET). As a result of these limitations, an NJDEP and USGS redesign committee was formed to improve the network design. This redesigned network, which includes a probabilistic monitoring component, is described below.

### **Redesigned Ambient Stream Monitoring Network**

In October, 1997, NJDEP and USGS began implementation of a redesigned Ambient Stream Monitoring Network (ASMN). The major goals of this network are to: identify water quality status and trends, identify emerging issues, identify transfer relations (land use- water quality relationships) on a watershed management area basis. By overlying many ASMN stations with the AMNET stations, concurrent chemical and benthic macroinvertebrate data will be available to facilitate source and cause assessments. The redesigned ASMN includes elements of USGS's National Water Quality Assessment program (see Leahy, et al. 1990; Gilliom, et al. 1995; and Vecchia S. et al, 1997). The redesigned Ambient Stream Monitoring Network consists of 115 stations (an increase from 78 stations). The following types of stations are being sampled:

Reference stations have been established in the four physiographic regions (Valley and Ridge, Highlands, Piedmont, Coastal Plain) of the state. In order to characterize water quality in natural settings, without pollutant inputs from sewage treatment plants, septic systems or storm water runoff, the six reference stations have been placed in parks and undeveloped areas. Data from these stations will be used to evaluate degradation in developed areas and to provide additional data to support surface water quality standards.

To characterize the effects of land use on water quality, 40 Land Use Indicator stations have been established statewide. These stations were selected to monitor the two most dominant land uses within each of the state's 20 watershed management areas. Drainage area size, and percent of

urban, agricultural, and forest were evaluated to select these stations. The biological health of many land use indicator stations is monitored through the DEP's Ambient Biomonitoring Network. These data will provide insight into the biological effects of chemical pollutants, and the effects of nonpoint sources from dominant land uses on chemical and biological water quality.

To provide a probabilistic component for estimating statewide water quality indicators, 40 Status stations have been established. Two stations, from the set of 763 AMNET stations, were selected at random in each of the state's 20 watershed management areas. This random selection process will be repeated each year to increase spatial coverage. These stations will also provide data at an ever-increasing number of locations, and can potentially identify problems that were not identified through fixed-station monitoring. Because these stations were randomly selected, nine statewide status stations are also being sampled for other purposes (i.e., land use indicator station).

One Integrator station has been located at the downstream end of each watershed management area. These stations will be used to characterize the combined effects of pollutants from all land uses and point sources that are transported down the river. Data collected at integrator stations (at or above head of tide), and tidal stations will be used to assess pollutant transport to back bays.

There are Watershed Reconnaissance stations that can be sampled each year to address specific issues or questions that are not addressed through other stations. For example, the watershed reconnaissance stations could be used to investigate the causes of impairment at benthic macroinvertebrate stations, provide preliminary watershed assessments, investigate point source impacts, and support the planned air deposition monitoring network. These stations will be selected each year based on DEP program needs. The number of stations and sampling frequency will reflect the data needs; funding is available for about 40 sampling events per year.

The redesigned network is sampled 4 times per year (a reduction from 5 times per year) for conventional parameters, including nutrients, dissolved oxygen, pH, suspended sediments and dissolved salts. Metals monitoring occurs once per year at reference and statewide status stations. A significant new component is the addition of volatile organic chemicals (VOCs) and currently used pesticides VOCs 2 times per year has been added at the 6 reference stations and 40 statewide stations. Bacterial concentrations, which were previously monitored throughout the year, are now being monitored in the summer only to provide a more accurate assessment of swimmable designated use attainment. Previously, dissolved oxygen was monitored during the day, not during the night-time low in the diurnal cycle. Under the redesigned network, diurnal dissolved oxygen data will be collected to monitor the 24 hour cycle at a subset of stations.

Through a research project, NJDEP, USGS, EPA and the Rutgers/Environmental and Occupational Health Sciences Institute will continue to evaluate the monitoring program design and will develop a data analysis guidance manual to address assessment methods for the 5 types of monitoring stations (i.e., reference, land use indicator, statewide status, integrator, watershed reconnaissance).



Network data are available from EPA's STORET system and USGS Annual Water Year Reports. For the next several years, trend data will only be available from the 41 stations that were monitored in the previous design. Status results will be available in 1999.

### **Coastal Monitoring**

The coastal surface water monitoring network has also been redesigned to include monitoring of the tidal portions of the State's rivers. Up until 1997, routine monitoring occurred only above the head of tide and below the mouth of most of New Jersey's rivers within open bays and the ocean. These tidal river sections are now assessed by the Bureau of Marine Water Monitoring which historically has been also responsible for the National Shellfish Sanitation Program, described below. The current coastal assessment program includes the collection and statistical analysis of water quality data including dissolved oxygen, nutrients, transparency and chlorophyll *a*. Reports on the coastal waters are available from the Bureau of Marine Water Monitoring, both in paper form and through the Department's internet web site. Biological monitoring of tidal waters are also performed by the Department and is described under "Ambient Biological Network" below.

### **Lake Monitoring**

The Clean Lakes Program collects and compiles data from Clean Lakes restoration projects. These data were used to develop the aquatic life designated use attainment assessment provided in Chapter 3 of this report and have been reported by NJDEP as an environmental indicator. The description of this program is provided for informational purposes; this program has not changed since the 1996 Water Quality Inventory Report.

There are 380 public lakes in the State with a total of 24,000 acres. To date, 116 lakes, totaling 10,462 acres have been evaluated for trophic status/recreational water quality impairment. These data were not collected as part of a routine monitoring program. Therefore, site selection criteria varied, and include sites with known water quality problems and sites with unknown water quality. Sampling design and sample collection frequency also varied depending upon the nature of the project. The last round of statewide sampling was completed in 1992; results after that date would be limited to Clean Lakes Restoration projects for a particular lake. Lakes were sampled for parameters associated with lake trophic analysis: nutrients (nitrogen and phosphorus), dissolved oxygen, pH, and algal identification and chlorophyll *a*. Trophic assessments are based on Trophic State Criteria, as described in USEPA's Clean Lakes Program Guidance Manual, based upon total phosphorus, chlorophyll *a*, and secchi disk transparency. Consideration may also be given to documented impairments caused by other factors, such as excessive macrophyte populations, bacterial contamination, or sedimentation. Some of these data are stored in STORET; the remaining data are available from reports or in-house databases maintained by Water Monitoring Management.

### **National Shellfish Sanitation Program**

The National Shellfish Sanitation Program (NSSP) collects data on the levels of fecal coliform in shellfish and waters that are harvested for shellfish. These data were used to develop the shellfish consumption portion of the fish and shellfish consumption designated use assessment. These data were summarized in the New Jersey State of the Environment Report (NJDEP, 1998a) and will be reported as an environmental indicator in the future. The description of this program is provided

for informational purposes; this network has not changed since the 1996 Water Quality Inventory Report.

The NSSP was established by the Surgeon General in 1925 and is active in all coastal states involved in interstate shellfish harvest and sale to safeguard the public health from the consumption of contaminated shellfish. One portion of the program requires shellfish producing states to classify their coastal waters according to suitability for safe shellfish harvest. Part of the assessment of these waters for safe shellfish harvest involves the monitoring of pathogen levels in those waters and shellfish. NJDEP's Water Monitoring Management program maintains a network of more than 2,500 monitoring stations throughout the State's coastal waters. These stations are sampled between five and twelve times each year for total coliform and fecal coliform bacteria (indicators of human pathogens). The resulting data are analyzed for compliance with federal standards. The program also evaluates pollution sources and performs assessments of hydrographic and meteorological conditions that may impact sanitary water quality.

Waters in compliance with standards are open for shellfish harvest; waters partially in compliance may be open seasonally or opened under special conditions (i.e., the shellfish are relayed to regions with good quality water and harvested after 30 days, to allow for purging of harmful pathogens). Waters with significantly elevated bacterial levels and waters around sewage and CSO outfalls are permanently closed to shellfish harvest.

#### **Cooperative Coastal Monitoring Program (CCMP)**

The Cooperative Coastal Monitoring Program (CCMP) compiles fecal coliform and beach closing data collected by local and county health officials. These data were used to develop the swimmable designated use attainment assessment for bays and ocean beaches. These data were also summarized in the New Jersey State of the Environment Report and will be reported in the future as an environmental indicator. The description of this program is provided for informational purposes; this network has not changed since the 1996 Water Quality Inventory Report.

NJDEP and the Department of Health and Senior Services oversee fecal coliform monitoring at ocean and bay bathing beaches performed by the county health departments of Cape May, Monmouth, Atlantic and Ocean Counties; as well as the regional health agencies of Atlantic City, Long Beach island, Long Branch, Matawan and Middletown. These data are used to close bathing beaches, as necessary, to protect public health from waterborne pathogens in swimming areas.

#### **Fish Tissue Monitoring**

Through the Interagency Toxics in Biota Committee, research projects are coordinated to monitor levels of contaminants in commercially and recreationally harvested fish, shellfish and crustacea species. Edible portions of individual animals are tested for one or more bioaccumulative chemicals (e.g., PCB's, chlorinated pesticides, dioxins, mercury). These data are evaluated for the development of consumption advisories and bans as appropriate to protect human health. Currently, NJDEP does not have a dedicated funding source to support a routine fish tissue monitoring program; projects are conducted as funding becomes available.

Several of New Jersey's consumption advisories are based on data collected 10 years ago. Through a special appropriation from Governor Whitman, the Interagency Toxics in Biota Committee is coordinating a research project to evaluate current levels of contaminants in fish tissue that have had advisories in place for 10 years. Results from this project will be summarized in a subsequent State Water Quality Inventory Report.

### **Compliance Monitoring**

Monitoring at selected NJPDES facilities throughout the state is performed by the Water Compliance and Enforcement Program, to determine their compliance with discharge permit conditions as per N.J.S.A. 58:10A-6l(1).

### **Special Studies**

As per the needs of the Department, the NJDEP's Water Monitoring Management program located within the Division of Watershed Management performs water quality studies on an as needed basis. The program is presently monitoring heavy metal concentrations in order to evaluate current conditions and potential toxicity at locations listed on New Jersey's List of Water Quality Limited Waters [303(d) List].

### **Comprehensive Assessments Of Water Quality In New Jersey**

USEPA has established a long-term goal of comprehensively characterizing surface and ground waters of each state. Also, NJDEP has been implementing a "Results-Based Management" approach, which is based on cooperative efforts with stakeholders to establish goals and measurable targets (milestones), implementing appropriate strategies and using indicators to measure progress. In the water programs, results-based management is being implemented through the water components of the draft NJDEP Strategic Plan, National Environmental Performance Partnership Agreements (NEPPS), and program workplans. Environmental and program progress is being reported through the State of the Environment Report (NJDEP, 1998a) and an Environmental Indicators Technical Report (NJDEP, 1998).

To support EPA and NJDEP goals and development of scientifically sound environmental indicators, the Department has begun to employ probabilistic monitoring and assessment techniques to facilitate assessment of state-wide status of surface and ground water quality. Probabilistic techniques allow for estimations of water quality in similar, but unsampled, locations. The degree of uncertainty in estimations is affected by the number of samples, frequency of sampling and scatter in the results.

In addition, the Department has recently formed a Water Assessment Team in the Division of Science, Research and Technology. This Team is responsible for assessing surface and ground water quality data to support the Water Quality Inventory Report (305b), the Impaired Waterbodies Listing (303d), Watershed Characterization and Assessments and Water Quality Indicators.

### **Surface Water**

The redesigned Ambient Stream Monitoring Network (ASMN) was described previously in this

Chapter (see Chapter V, Surface Water Monitoring Programs). This section focuses on the probabilistic aspects of this monitoring program, which are provided primarily through the Statewide Status stations.

The Statewide Status stations were selected via a stratified random selection process from the universe of 763 AMNET stations. In the AMNET program, at least one station was selected along every first order stream that is at least 3 miles long; and one station was selected along every second order stream. First order streams have no tributaries; second order streams have only first order streams as tributaries. In general, stations are located every 3 miles along first and second order streams. Second and third order stream stations are located before the confluence of major tributaries to provide a cumulative measure of water quality conditions of upstream segments. Known sources of contamination and significant natural features (e.g., freshwater wetlands, preserves, wildlife management areas, etc.) were also considered when selecting sampling locations. Station locations were also modified by site accessibility and safety considerations for sampling personnel.

Two statewide status stations per watershed management area were selected at random from the universe of AMNET stations and will be sampled 4 times per year. This random selection process will be repeated each year, providing an expanding coverage on a state-wide basis. These stations may identify water quality concerns that were not identified through other stations and will provide chemical data at AMNET sampling locations. Sampling began as part of a new surface water monitoring program in 1997.

As mentioned earlier, as part of the new redesigned Ambient Stream Monitoring Network, NJDEP, USGS, EPA and the Rutgers/Environmental and Occupational Health Sciences Institute will be reviewing the data analysis and assessment methods for this effort (as well as the new network as a whole) and will make recommendations for improvement.

### **Ground Water**

The proposed redesign of the Ambient Ground Water Quality Monitoring Network was described previously in Chapter IV (See Proposed Redesign of the Ambient Ground Water Quality Monitoring Network). This section focuses on the probabilistic aspects of the proposed Ambient Ground Water Quality Monitoring Network (AGWQN). As with the Ambient Stream Monitoring Network, the data from this network are expected to support statistically sound evaluations of ground water quality for use as environmental indicators.

Wells will be located using a stratified random design that considers physiographic province, watershed management areas and land uses (i.e., agricultural, urban/suburban and undeveloped). This probabilistic approach will facilitate estimations of the effects of land use in each physiographic province and watershed management area on shallow ground water quality. For example, a median concentration of a parameter in shallow ground water below each land use could be estimated using methods described in Spruill and Candela (1990). Statewide concentrations could be estimated based on the total amount of each land use in the state. The accuracy of these estimates will be affected by the total number of wells, frequency of sampling and scatter in the data. Despite these uncertainties, the proposed network design will provide a

statistical basis for estimation of shallow ground water quality on a statewide basis, thus supporting scientifically valid ground water quality indicators. Data collection for ground water is scheduled to begin in mid-1999.

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